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**QUARTERLY PROGRESS REPORT  
A STUDY OF TUNGSTEN-TECHNETIUM ALLOYS  
JANUARY 1, 1966-APRIL 1, 1966**

**R. S. KEMPER  
D. P. O'KEEFE**

MARCH, 1967



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By

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March 1967

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INTRODUCTION

Technetium is a sister element to rhenium and has many properties that are similar to rhenium. It is predicted that technetium will have about the same effects on tungsten as rhenium in regard to increase in workability, lowered ductile-to-brittle transition temperature, and improved ductility.

The objectives of the current work are to recover technetium from fission product wastes at Hanford and reduce to purified metal; prepare W-Tc alloys containing up to 50 at.% Tc; fabricate the alloy ingots to sheet stock, assessing the effect of technetium on workability; and perform metallurgical and mechanical property evaluation of the fabricated alloys.

Previous reports have described the separation and purification of 800 g of technetium metal powder, melting of technetium and W-Tc alloys, and some properties of the arc cast alloys.

CURRENT PROGRESS

TEST METHOD DEVELOPMENT

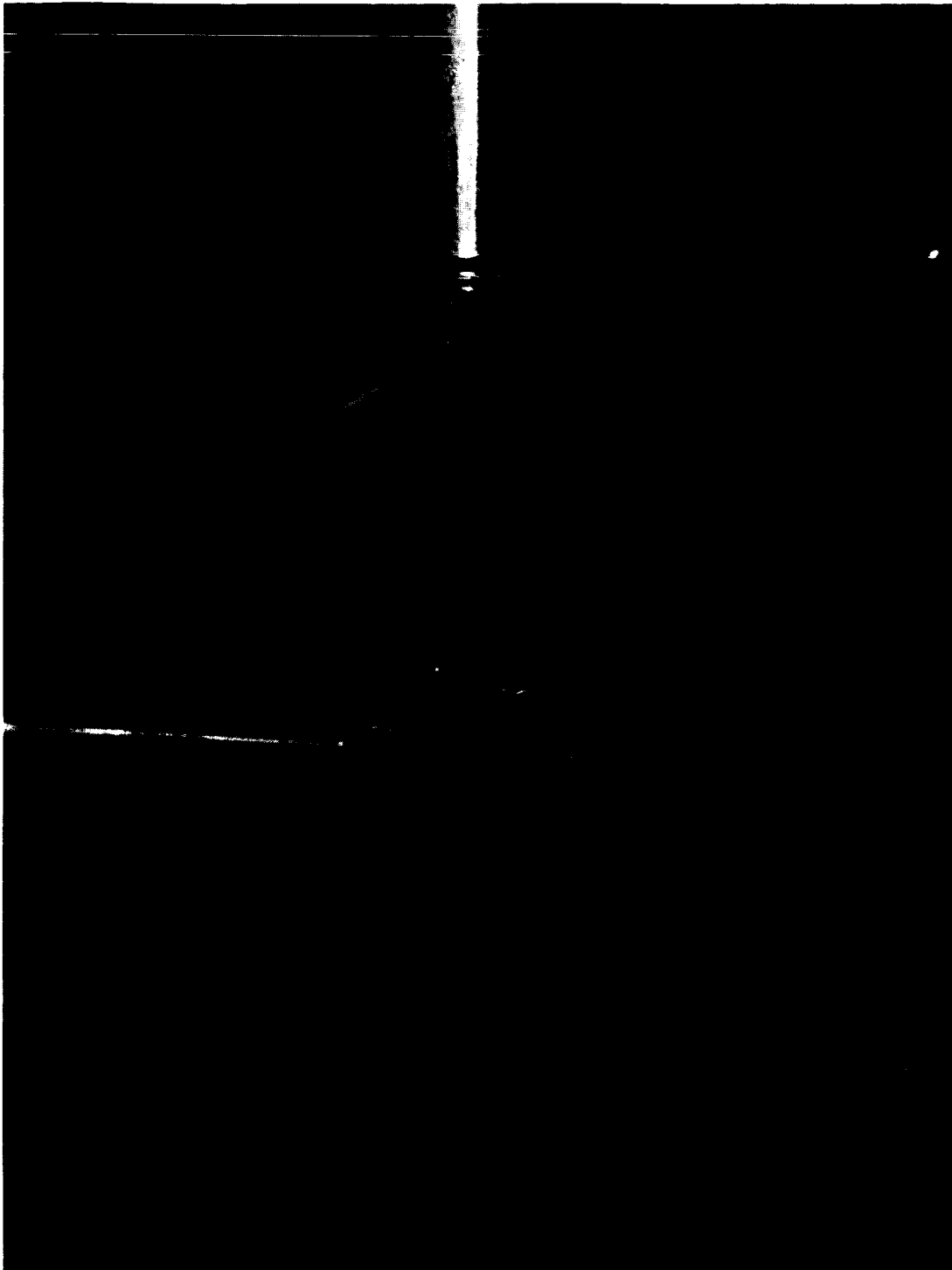
The first fabricated alloys of W-Tc will be in the form of small sheet specimens varying in thickness between 0.020 and 0.050 in. The initial mechanical properties testing to be done on these alloys will be to determine the effect of technetium content on the ductile-brittle transition temperature. A test method is being sought which can be used for

determining this parameter on a very small amount of material. For this purpose a bend test fixture, as shown in Figure 1, has been built. When this fixture is mounted in a test machine, a 3/4 in. long specimen can be loaded as a simple beam. Temperature control is provided with a circulating air oven.

Tests on pure tungsten have shown that the onset of cracking in the bend test specimen is usually adequately indicated by a drop in the test machine load indication. Some specimens of highly wrought tungsten, however, tend to exfoliate, and transverse cracking does not progress far enough in one step to give a clear indication on the load measuring system. Also, it is difficult to fit this type of specimen back together to determine bend angle at the initiation of failure. Therefore, a telescope was built to allow visual sighting of the first crack which in this test appears on the top surface of the specimen. The telescope, shown in Figure 2, provides about 15X magnification at a 12 in. distance.

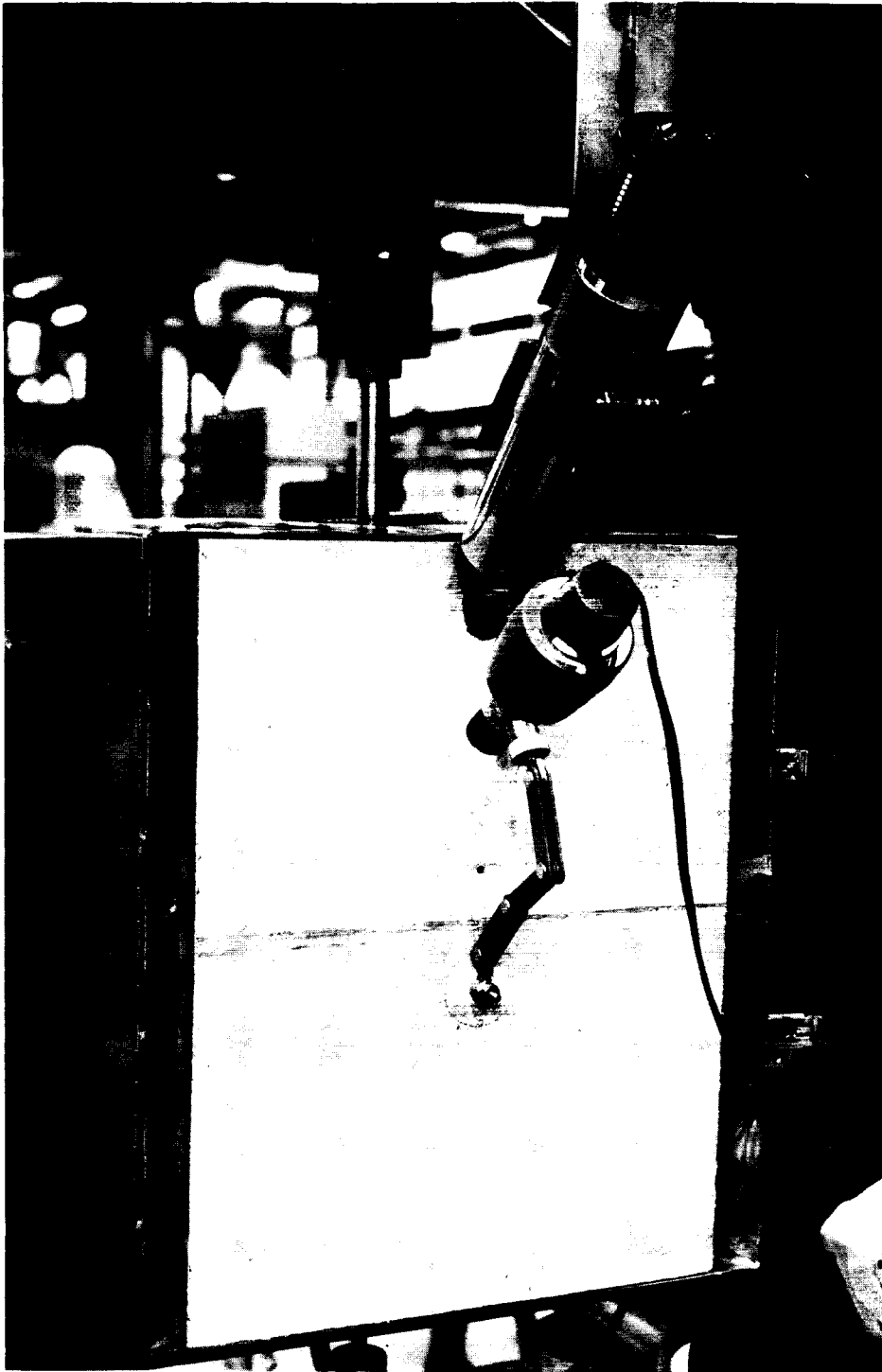
Ductile-brittle transition data for pure tungsten specimens obtained in the process of evaluating the test method are shown in Figure 3. These data were obtained from bend specimen 3/4 x 1/4 in.

The main thing that remains to be done to implement this test method is to establish a procedure for defining the permanent set before fracture in terms of bend angle and thickness.



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FIGURE 1. *Bend Test Fixture on Instron Test Machine*



*Neg 0661006-1*

FIGURE 2. *Sighting Telescope for Bend Test*



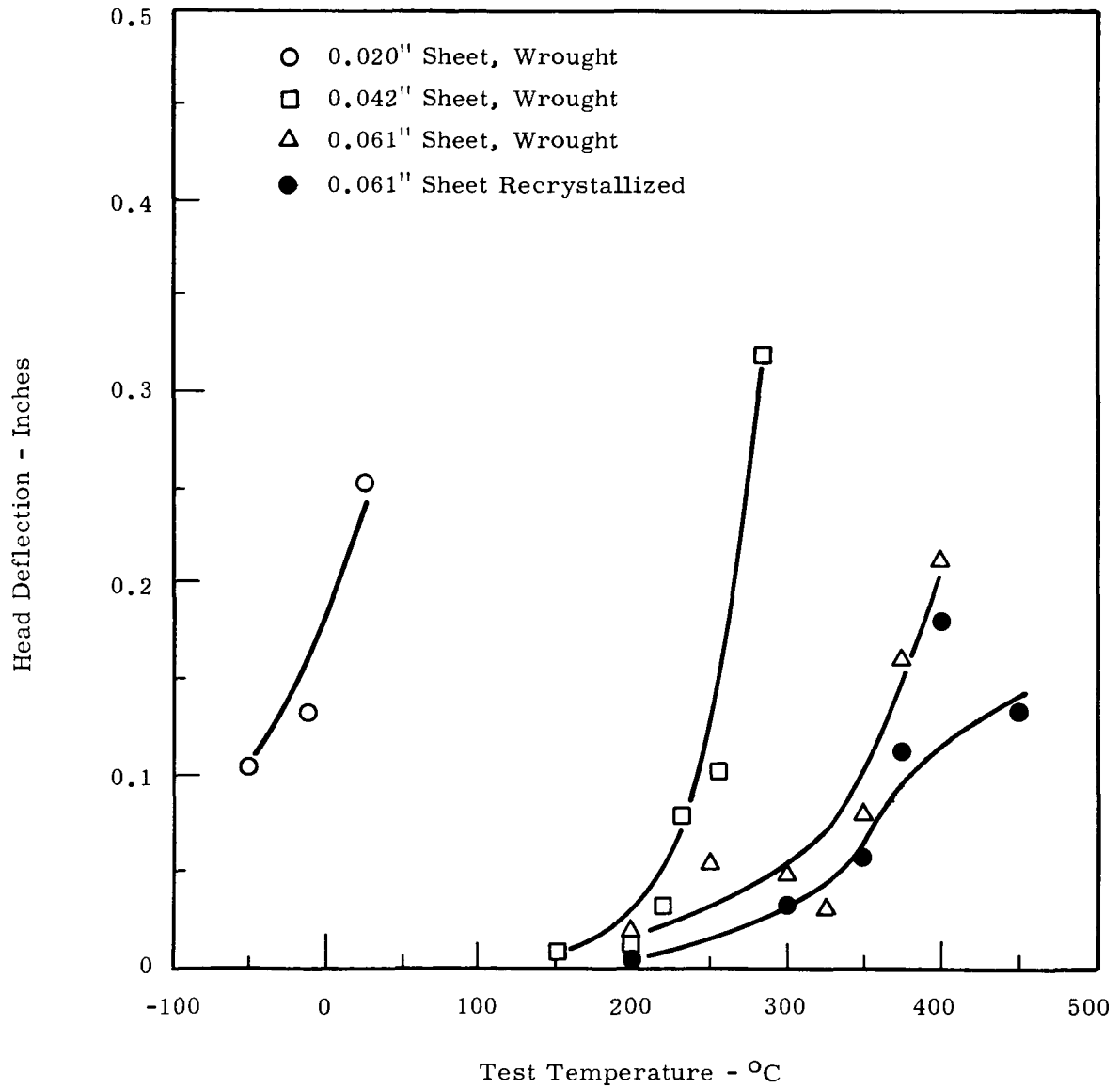


FIGURE 3. Ductile-Brittle Transition Temperatures for Tungsten Sheet Determined by Bend Test. Data points indicate the total deflection imparted to a simple beam to cause fracture.

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